# REPORT OF THE COMMITTEE OF THE AMERICAN MATHEMATICAL SOCIETY ON DEFINITIONS OF COLLEGE ENTRANCE REQUIREMENTS IN MATHEMATICS.

AT the summer meeting of the American Mathematical Society, in September, 1902, a special committee was appointed to prepare standard formulations of college-entrance requirements in mathematics, in co-operation with committees already appointed by the Society for the Promotion of Engineering Education and the National Educational Association. The following report has been prepared by the committee of the Mathematical Society, taking due account, on the one hand, of previous work along similar lines, as represented for example in the mathematical definitions of the College Entrance Examination Board and the Commission of Colleges in New England, and, on the other hand, of existing conditions in the mathematical instruction of colleges and schools.

The membership of the committee represents various forms of higher education only, but advice of value has been sought and obtained from other members of the Mathematical Society and from secondary teachers.

In its selection of topics the committee has aimed to emphasize fundamental matters of principle, and to omit complicated processes and subjects not capable of rigorous treatment in the secondary school.

By the selection of subjects it is not implied that all should be required by any one college, or be taught in any one school.

## REPORT.

The committee understands its duties in the following sense:

1. To specify those mathematical subjects which are generally recognized as appropriate requirements for admission to colleges and scientific schools.

2. To specify details under these subjects in such a manner as to represent the standards of the best secondary instruction—

the word "best" being interpreted in a qualitative rather than a quantitative sense.

3. The committee understands also that the consideration of pedagogic questions is not primarily among its duties.[1] It has therefore made no attempt to deal with methods of secondary education in mathematics, or the order of taking up the subjects and their correlation with each other and with other sciences. The order in which the subjects and the topics under them are presented below does not necessarily imply preference of the committee as to order of teaching either the subjects or the topics. It is the opinion of the committee that these are the subjects and the topics which, according to the best present usage, should be offered for admission to colleges and scientific schools.

The formulation is not to be interpreted as exhaustive. It represents rather the extent to which, in the opinion of the committee, definite specification should be undertaken by it; it is expected that further details will be determined in accordance with the judgment of the particular college, school, or teacher.

The definitions proposed are based on present usage and standards. In case of divergence between standard text-books and what seemed a more scientific presentation of the subject in question, the committee has endeavored to make a choice which should not depart so far from current usage as to involve hardship to schools or teachers. The committee is of opinion that no formulation should be considered as having more than temporary validity. No advantages attendant upou uniformity of definition could counterbalance any tendency of the definitions to retard progress of secondary education in mathematics. It is therefore recommended that, if the definitions are approved, they be revised at intervals, perhaps of ten years.

SUBJECTS.

1. Elementary algebra.
2. Plane geometry.
3. Solid geometry.
4. Trigonometry.
5. Advanced algebra.

[1] Reference may be made to the important work of recently formed societies for the improvement of mathematical teaching.

DEFINITIONS.

1. *Elementary algebra.*—The four fundamental operations for rational algebraic expressions.

Factoring, determination of highest common factor and lowest common multiple by factoring.

Fractions; including complex fractions, ratio and proportion.

Linear equations, both numerical and literal, containing one or more unknown quantities.

Problems depending on linear equations.

Radicals, including the extraction of the square root of polynomials and of numbers.

Exponents, including the fractional and negative.

Quadratic equations, both numerical and literal.

Simple cases of equations with one or more unknown quantities, that can be solved by the methods of linear or quadratic equations.

Problems depending on quadratic equations.

The binomial theorem for positive integral exponents.

The formulas for the $n$th term and the sum of the terms of arithmetic and geometric progressions, with applications.

It is assumed that pupils will be required throughout the course to solve numerous problems which involve putting questions into equations. Some of these problems should be chosen from mensuration, from physics, and from commercial life. The use of graphical methods and illustrations, particularly in connection with the solution of equations, is also expected.

2. *Plane geometry.*—The usual theorems and constructions of good text-books, including the general properties of plane rectilinear figures; the circle and the measurement of angles; similar polygons; areas; regular polygons and the measurement of the circle.

The solution of numerous original exercises, including loci problems.

Applications to the mensuration of lines and plane surfaces.

3. *Solid geometry.*—The usual theorems and constructions of good text-books, including the relations of planes and lines in space; the properties and measurement of prisms, pyramids, cylinders, and cones; the sphere and the spherical triangle.

The solution of numerous original exercises, including loci problems.

Applications to the mensuration of surfaces and solids.

4. *Trigonometry.*—Definitions and relations of the six trigonometric functions as ratios; circular measurement of angles.

Proofs of principal formulas, in particular for the sine, cosine, and tangent of the sum and the difference of two angles, of the double angle and the half angle, the product expressions for the sum or the difference of two sines or of two cosines, etc.; the transformation of trigonometric expressions by means of these formulas.

Solution of trigonometric equations of a simple character.

Theory and use of logarithms (without the introduction of work involving infinite series).

The solution of right and oblique triangles, and practical applications, including the solution of right spherical triangles.

5. *Advanced algebra.*—Permutations and combinations, limited to simple cases.

Complex numbers, with graphical representation of sums and differences.

Determinants, chiefly of the second, third, and fourth orders, including the use of minors and the solution of linear equations.

Numerical equations of higher degree, and so much of the theory of equations, with graphical methods, as is necessary for their treatment, including Descartes's rule of signs and Horner's method, but not Sturm's functions or multiple roots.

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